

REMARKS

This response is intended as a complete response to the Office Action dated February 21, 2007. In view of the following discussion, the Applicants believe that all claims are in allowable form.

CLAIM REJECTIONS

§103 Claims 1, 7, 9, 16, 21-22 and 31-45

Claims 1, 7, 9, 16, 21-22 and 31-45 stand rejected under 35 USC §103 as being unpatentable over United States Patent Application Publication No. 2001/0027023, published October 4, 2001 to *Ishihara* (hereinafter *Ishihara*) in view of United States Patent Application Publication No. 2002/0135761, published September 26, 2002 by *Powell et al.* (hereinafter *Powell*). The rejection is respectfully traversed.

Independent claims 1, 16, and 35 recite limitations not taught or suggested by any permissible combination of the cited art. *Ishihara* discloses a method of etching an organic layer using a plasma formed from an oxygen-containing gas, a hydrogen-containing gas, and a fluorine-containing gas. (*Ishihara*, ¶ [0019].) The non-deteriorated portion of the organic layer is ashed using an oxygen plasma in a second step. (*Id.*, ¶ [0137].) A monitor may determine when the etching is complete by monitoring the "light emission caused by CO and H as products from the resist or by O from the added gases." (*Id.*, ¶ [0135] (emphasis added).)

As such, *Ishihara* teaches monitoring the plasma for emissions caused by products from the resist or by the added gases. However, *Ishihara* fails to teach or suggest monitoring a plasma used for removing (claim 1) or etching (claims 16 and 35) a photoresist layer for both a byproduct optical emission and a reagent optical emission, as recited in independent claims 1, 16, and 35.

Powell generally discloses sampling gas outside a reaction chamber that has passed through the reaction chamber during a process. (*Powell*, ¶ [0006].) More specifically, *Powell* teaches that upon the gas passing out of the reaction chamber, the gas diffuses into an excitation chamber and is excited therein to emit radiation. (*Id.*) A plurality of wave bands of an emission spectrum is detected, and a process may be controlled based on the detected wave bands. (*Id.*)

However, *Powell* fails to teach or suggest monitoring a plasma in a process chamber used for removing or etching a photoresist layer. To the contrary, *Powell* teaches forming a second plasma external to the chamber and to any plasma formed therein (for example during a cleaning process as given in one example by *Powell*). Accordingly, *Powell* explicitly teaches to exclusively monitor gases contained in an exhaust flow emerging from a reaction chamber (e.g., within a dedicated, external excitation chamber). As such, *Powell* fails to teach or suggest monitoring the plasma [used to remove a photoresist] for both a byproduct optical emission and a reagent optical emission during the process, as recited in claims 1, 16, and 32. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

In the Detailed Action section and in the Response to Arguments section of the present Office Action, the Examiner asserts that *Powell* teaches to monitor the plasma for byproduct optical emission and reagent optical emission and further that *Powell* teaches to detect both early and final endpoints in a process. The Applicants respectfully disagree.

In addition to the discussion above with respect to the teaching of *Powell* regarding monitoring a process effluent externally to the chamber, all portions of *Powell* cited by the Examiner (specifically, ¶¶ [0030], [0036], [0041], [0051], [0053], and Figure 11) – while discussing various ways to externally monitor a process effluent – fail to teach or suggest an etch process including monitoring the plasma formed in a process chamber to etch a photoresist and determining an early endpoint indicator by monitoring the plasma for a reagent optical emission while etching; and determining a final endpoint indicator by monitoring the plasma for a byproduct optical emission while etching, as recited in claim 35. Similar untaught limitations are recited in claims 42 and 43, depending from claim 1. Therefore, a *prima facie* case of obviousness has further not been established with respect to these claims as the combination of the cited references fails to yield the limitations recited in the claims.

With respect to claims 31, 33, and 39, the Examiner asserts that *Powell* teaches to determine the condition of the plasma source. However, the Applicants can find no teaching or suggestion of a determination of a condition of the plasma source in the

cited portion of *Powell*. Therefore, a *prima facie* case of obviousness has further not been established with respect to these claims as the combination of the cited references fails to yield the limitations recited in the claims.

With respect to claims 41, 44, and 45, the Examiner asserts that the teachings of *Powell* could be used to modify the process of Ishihara to meet the limitations recited in the claims. The Applicants respectfully disagree.

Powell teaches to monitor optical emissions from an external process effluent. In the portion relied upon by the Examiner, *Powell* provides a chamber clean process that may be monitored to determine when the chamber clean is complete. (See *Powell*, ¶¶[0051]-[0053].) Accordingly, if one were to modify *Ishihara* in view of *Powell*, the resultant process would be an independent chamber clean process run prior to or after the process of *Ishihara* during which optical emission monitoring of an external process effluent may be used to determine when the chamber clean process is complete. Such a process fails to teach or suggest removing (or etching) a photoresist layer using a plasma... and determining from at least one of the monitored optical emissions [of the photoresist etch or removal process] whether a cleaning cycle is necessary, whether components within the chamber are degrading, or both, as recited in the claims. Therefore, a *prima facie* case of obviousness has further not been established with respect to claims 41, 44, and 45 as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, independent claims 1, 16, and 35, and claims 7, 9, 21-22, 31-34 and 36-45, dependent thereon, are patentable over *Ishihara* in view of *Powell*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

§103 Claims 2, 6, 14, and 17

Claims 2, 6, 14, and 17 stand rejected under 35 USC §103(a) as being unpatentable over *Ishihara* and *Powell* and further in view of United States Patent Application Publication 2002/0151156, published October 17, 2002 by *Hallock, et al.* (hereinafter *Hallock*). The Applicants respectfully disagree.

The patentability of claims 1 and 16 over *Ishihara* and *Powell* is discussed above. *Hallock* discloses a method for removing a hardened crust on a photoresist after

exposure an ion implantation process. However, like *Ishihara* and *Powell*, *Hallock* also fails to teach or suggest monitoring a plasma used for removing or etching a photoresist layer for both a byproduct optical emission and a reagent optical emission, as recited in independent claims 1 and 16. As such, *Hallock* fails to teach or suggest a modification to the teachings of *Ishihara* and *Powell* that would result in the limitations recited in the claims. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, claims 2, 6, 14, and 17 are patentable over *Ishihara* in view of *Powell* and further in view of *Hallock*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

§103. Claims 28, 30

Claims 28, 30 stand rejected under 35 USC §103(a) as being unpatentable over *Ishihara* and *Powell* and further in view of United States Patent No. 6,419,801, issued July 16, 2002 to *Smith, Jr. et al.* (hereinafter *Smith*).

The patentability of claim 1 and 16 over *Ishihara* and *Powell* is discussed above. *Smith* discloses monitoring a range of aspects of plasma processing operations. However, like *Ishihara* and *Powell*, *Smith* also fails to teach or suggest monitoring a plasma used for removing or etching a photoresist layer for both a byproduct optical emission and a reagent optical emission, as recited in independent claims 1 and 16. As such, *Smith* fails to teach or suggest a modification to the teachings of *Ishihara* and *Powell* that would result in the limitations recited in the claims. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, claims 28 and 30 are patentable over *Ishihara* in view of *Powell* and further in view of *Smith*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

CONCLUSION

Thus, the Applicants submit that all claims now pending are in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issuance are earnestly solicited.

If, however, the Examiner believes that any unresolved issues still exist, it is requested that the Examiner telephone Mr. Alan Taboada at (732) 935-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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